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ABSTRACT

Collaborative learning is receiving increased attention within educational environments. With increasing use of technology to support collaborative techniques it is critical that existing research in this area is expanded. This study was initiated to examine and explore the perceptions of students relative to experiences within two types of problem solving teams--one with a technology supported collaborative environment and the other without such support. Rankings related to prior attitudes about collaborative work-related issues and post-perceptions related to quality of discussions, satisfaction with the group process, and satisfaction with outcome were collected using a survey instrument containing Likert-scale statements. The data was analyzed using correlations between prior attitudes and the post-perceptions. Results indicate that significant differences exist that relate to the process by which problems are solved. The evidence reveals that the difference in treatments is the overriding reason for the perceptions reported. Contains 20 references. (Author/AEF)

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Problem Solving in the Virtual Classroom: A Study of Student Perceptions Related to Collaborative Learning Techniques

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Abract: Collaborative learning is receiving increasing attention within educational environments. With increasing use of technology to support collaborative techniques it is critical that existing research in this area is expanded. This study was initiated to examine and explore the perceptions of students relative to experiences within two types of problem solving teams - one with a technology supported collaborative environment and the other without such support. Rankings related to prior attitudes about collaborative work-related issues and post-perceptions related to quality of discussions, satisfaction with the group process, and satisfaction with outcome were collected using a survey instrument containing Likert-scale statements. The data was analyzed using correlations between prior attitudes and the aroremented post-perceptions.

Introduction

A major shift in learning, the locus of which is increasing attention on constructivism, is being integrated into traditional and distance learning environments. The constructivist paradigm has been described as focusing on learner-centered instruction (Leidner and Jarvenpaa, 1995), discovering conceptual relationships, exploring multiple representations and perspectives, and/or immersing the learner in the real-world context in which learning is relevant (Jonassen 1993).

Collaborative learning, a technique that supports the principles of constructivism, involves small groups of students working together to solve assignments. This concept is described by Whipple (1987) as including 1) an active role by both teachers and learners, 2) the culture of the learning environment, and 3) the view that knowledge is not transferred from expert to learner, but rather created and located in the learning community. The value of teamwork in learning is well supported by Alavi (1994) who explains that this kind of learning extends cognitive activity and team members are able to monitor individual thinking, opinions, and beliefs providing feedback that results in clarification and change. Alavi believes that cooperation and teamwork foster social support and encouragement and therefore support learning by problem solving, a means to extend, test, and refine mental models until they are both effective and reliable.

Although same-time, same-place, synchronous learning techniques have been the norm for collaborative experiences for many years; the integration of technology within the academic community has expanded the possibilities of collaboration to include students who are not physically in the same location. Thus, any-time, any-place, asynchronous learning has created new opportunities for students and is a technique associated with distance education. Distance education is described by Verduin and Clark (1991) as a formal approach to learning in which most instruction occurs while educator and learner are a distance from each other. Included among the numerous reasons for providing distance opportunities are:

1) people who need to learn together are scattered over broad areas,
2) people who need to learn are restricted in the times they can devote to learning,
3) face-to-face experiences are simply becoming too costly, and

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4) face-to-face experiences do not cater to diversity.

Computer-supported collaborative work is the term applied to how people work together online despite being separated by space and in time (Hiltz and Wellman, 1997). Morrison (1994) relates computer conferencing to collaborative techniques and distance options and describes computer conferencing as an asynchronous method in which students can keyboard comments outside of class and at their own convenience. He emphasizes that conferencing facilitates the debating of issues, clarifying of concepts, and the asking of questions as part of a collaborative community. Hiltz and Wellman underscore the idea that computers support social networks formed by linking people as well as machines. Conferencing technologies are said to facilitate the extension of concepts beyond the typical classroom, offering unique opportunities for students to be part of a community of practice (Bonk, Appleman, and Hay, 1996). Morrison (1994) views computer conferencing as a means of providing a forum for students who may ordinarily refrain from discussion and he sees the technology as supporting spontaneous problem-solving which results in a new dimension to applying prior learning.

Other benefits reviewed by Berge and Collins (1993) include professional growth, convenience, independence of time and distance, and the removal of participation barrier. There is evidence that electronic classrooms may induce student interaction (Bump, 1990; Slatin, 1990). Hiltz (1989) would agree and notes that the virtual classroom creates more communication among a learning group as opposed to the more typical teacher and student communication found in many classrooms. While these benefits are a draw, Berge and Collins also review limitations such as learning curves, lack of social cues, access requirements, and hardware constraints. The lack of non-verbal cues might diminish "social presence" (Short, Williams, and Christie, 1976) and communication content may cause a sense of depersonalization (Hiltz, 1989).

Against this backdrop, educators must consider consequences from extending collaborative experiences via technology. We describe a setting in which collaborative is integrated and analyze student perceptions in two distinct situations:

1) same time/same place (synchronous) conventional classroom context, and
2) a computer conferencing virtual classroom whereby students participate any time/any place (asynchronous).

The purpose of this study is to identify predominant issues that emerge as we extend collaborative opportunities across distances.

The Research

Eighty-three students, enrolled in an upper-level, undergraduate class in programming or in a graduate course in the management of information resources, participated in the experiment. The tasks are best defined in terms of decision-making and problem-solving. Thirty-seven students were asked to develop a computer program assigned as part of course requirements in object oriented programming. The principles underlying object oriented programming are those that encompass any problem-solution environment, i.e. discussion of the problem and developing a solution. Forty-six students were asked to participate in a case problem using the same conceptual principles.

Projects were designed such that students were required to interact on a regular basis. Every participant knew that subsequent peer and instructor evaluation impacted his/her project grade. All subjects worked collaboratively to achieve a goal - in the former case a completed program and in the latter case, an analysis of the case and recommendations. First Class, ©SoftArc, Inc., computer conferencing software supported asynchronous team communication.

Two concurrent experiments were conducted. Subsequently, two additional experiments were conducted with teams reversing treatments. The treatments, each using collaborative techniques, were:

1) computer conferencing teams primarily using asynchronous communication and
2) face-to-face teams incorporating only synchronous communication.

Students, based upon background in computers and observed level of competency by the instructor, were assigned to teams varying in size from three to five persons. Thus, we presumed the teams to have mixed backgrounds both educationally and skill wise.

Specifically, the study analyzes perceptions of students with regards to quality of discussions, satisfaction with the group decision-making process, and satisfaction with the quality of outcomes. The results are compared among the two aforementioned collaborative techniques and also to student preconceptions about the value of teamwork, peer evaluation, task accomplishment, and comfort level working in a group. Background variables such as age, sex, student level, professor, and computer literacy were also analyzed and compared to post-experiment variables.

Two versions of the experimental task, both with similar difficulty, were administered to the students, yielding a 2 X 2 factorial design. This research design indicates that the subjects each had a chance to solve similar problems both synchronously and asynchronously. A majority of participants, 42 percent, were between the ages of 23 and 30. Another 39 percent were over the age of 30. All participants were either in the last two years of undergraduate study (28) or were engaged in graduate work (55). These facts are significant because they suggest an overall mature population.

We used two survey instruments to obtain the data. One instrument, administered prior to the experiment, was designed to capture student perceptions regarding the value of team collaboration, the effectiveness of tasks accomplished through collaborative efforts, the effectiveness of peer evaluation, and the comfort level working within groups. The second instrument, administered after the completion of each programming project or case, was used to acquire knowledge regarding student perceptions about the actual team experience. Rankings covered quality of the process, satisfaction with the process, and satisfaction with outcome.

Three definitive scales were examined in posttest rankings:

- Subjects' perceived quality of the discussions, recommendation, and solutions (Gouran, Brown, and Henry, 1978),
- Subjects' perceived satisfaction with the process used to reach a solution (Green and Taber, 1980), and
- Subjects' perceived satisfaction with the outcome/solution (Green and Taber, 1980).

Results

Table 1 shows that there are significant differences between the means of the two groups of students. The differences, however, are in the first two categories, i.e . quality of discussions and satisfaction with the process itself.

Dependent Variable Face-to-Face	Probability > F	R Square
Discussion Quality	.0534	.3931
Satisfaction with Process	.0001	.5774
Satisfaction Quality of Outcome	.2346	.2625

Table1: Comparison of Means - Face-to-Face and Computer Conferencing

Quality of discussions, satisfaction with the process, and satisfaction with outcomes were analyzed within each group using correlation analysis. The results, shown in Table 2, are presented below.

	Team Coll.	Peer Eval	Task	Com-fort	Lit	Age	Sex	Prof	Stud
Synchron.									
Discussion Quality	.570 .000*	.024 .832	.226 .040	.340 .002	.030 .786	.059 .608	.002 .988	.105 .344	.124 .264
Satisfaction Process	.510 .000*	-.006 .960	.259 .018	.344 .001	-.104 .351	-.018 .880	-.097 .396	-.099 .371	.084 .450
Satisfaction Outcomes	.356 .001	-.003 .980	.070 .534	.099 374	-.111 .320	.055 .640	-.086 .452	-.035 .757	-.033 .767
Asynch .									
Discussion Quality	.113 .313	-.120 .281	.171 .124	.083 .457	.013. 910	.057 .625	.087 .450	.065 .560	.049 .664
Satisfaction Process	.118 .313	-.171 .139	.170 .142	.195 .092	.048 .679	.143 .237	.173 .146	.000 1.00	.012 .918
Satisfaction Outcomes	.063 .596	.089 .449	.023 .842	.092 .433	-.004 .971	.028 .822	.067 .576	-.090 .445	.090 .445

Table 2: Correlation Analysis

Face-to-Face (Synchronous) Results:

1) There was a significant correlation between face-to-face post-test variables and pre-test feelings about the effectiveness of team collaboration.
2) There was also a significant correlation between pre-test feelings about task accomplishment and the post-test variables of discussion quality and general satisfaction with the problem-solving process.
3) Comfort level is positively correlated with discussion quality.
4) Interestingly, background variables of age, computer literacy, sex, student type (graduate or undergraduate) or professor are not significantly correlated with the results.

Computer Conferencing (Asynchronous) Results:

1) There were no significant correlations found between pre-test preconceptions about groups and the data collected as part of the post-test rankings.
2) The background characteristics reported by students, as with face-to-face method of problem solving, were not found to be correlated with post-test perceptions.

Summary and Conclusions

Students enrolled in information systems classes participated in an experiment whereby differences in attitudes towards collaborative learning were observed within two different learning environments - asynchronous and synchronous. Our conclusion is that significant differences exist that relate to the process by which problems are solved.

Distance and asynchronous opportunities, associated with computer conferencing, improve the perceived quality of the problem solving process and satisfaction with that process. There was a lack of differences associated with satisfaction of outcomes, which was initially surprising especially in light of the process variable results. However, upon further reflection, we believe the computer conferencing environment may provide more time than face-to-face environments for analysis and reflection. This supports the work of Alavi (1994), which attributes the extension of cognitive activity and ability to monitor individual thinking, opinions, and beliefs to computer conferencing. It should be noted that discussions and process are tied to interaction and in a face-to-face environment social cues are influential. The reduction of social pressures, referred to by Hiltz and Wellman (1997) as "reduced social presence," may very well be why these results have occurred.

Satisfaction with the quality of the outcome does not significantly differ among the research treatments. This is consistent with studies of distance education that repeatedly indicate that cognitive achievement of distance learning students is comparable with that of traditional classroom students (Barker and Platten, 1988, Ritchie and Newby, 1989). Several observations are relevant. First, outcome satisfaction is a result of the decision process and second, output is an end product that is graded. Thus, the process by which one solves a problem is separate and unique from the outcome.

Correlations between face-to-face pre test variables, i.e. feelings about the value of team collaboration and comfort level with teams, and posttest process variables as described above are understandable. These results indicate that previously held views are important in a face-to-face situation but are not a distraction in the distance environment. This is consistent with Johnassen (1995) who supported the use of technology to facilitate more meaningful learning.

It appears that background characteristics have no bearing on posttest results. Thus the evidence indicates that the difference in treatments is the overriding reason for the perceptions reported. In particular, we conclude that computer conferencing is a preferred means of communication in problem solving situations. We agree with researchers such as Alexander and Murphy (1994), and Wagner and McCombs (1995) who believe that distance education provides a natural forum for learner centered principles. Outcomes from distance learning will weigh heavily upon the techniques that support it.

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